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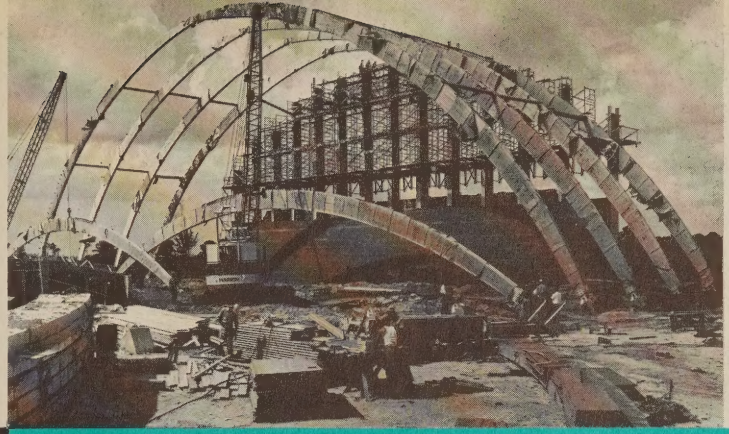
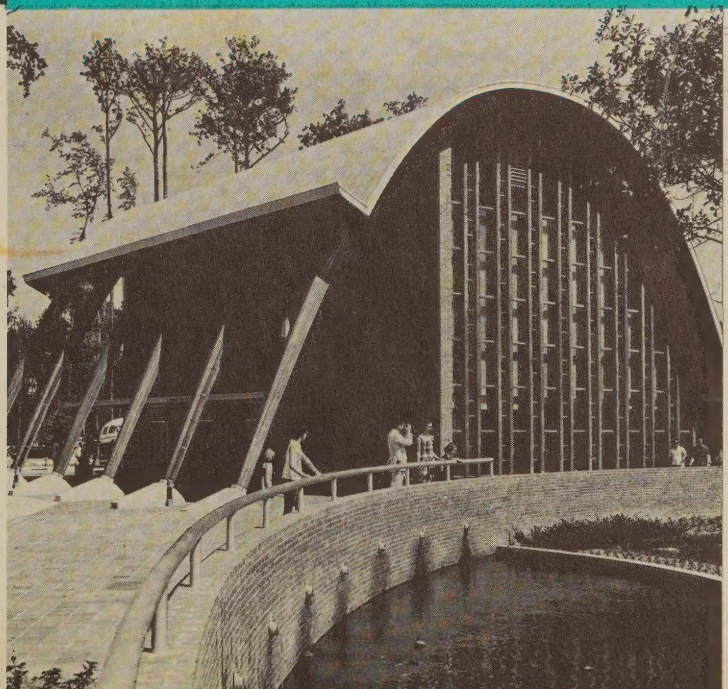


WOOD CONSTRUCTION DATA NO. 5

HEAVY TIMBER

Construction Details



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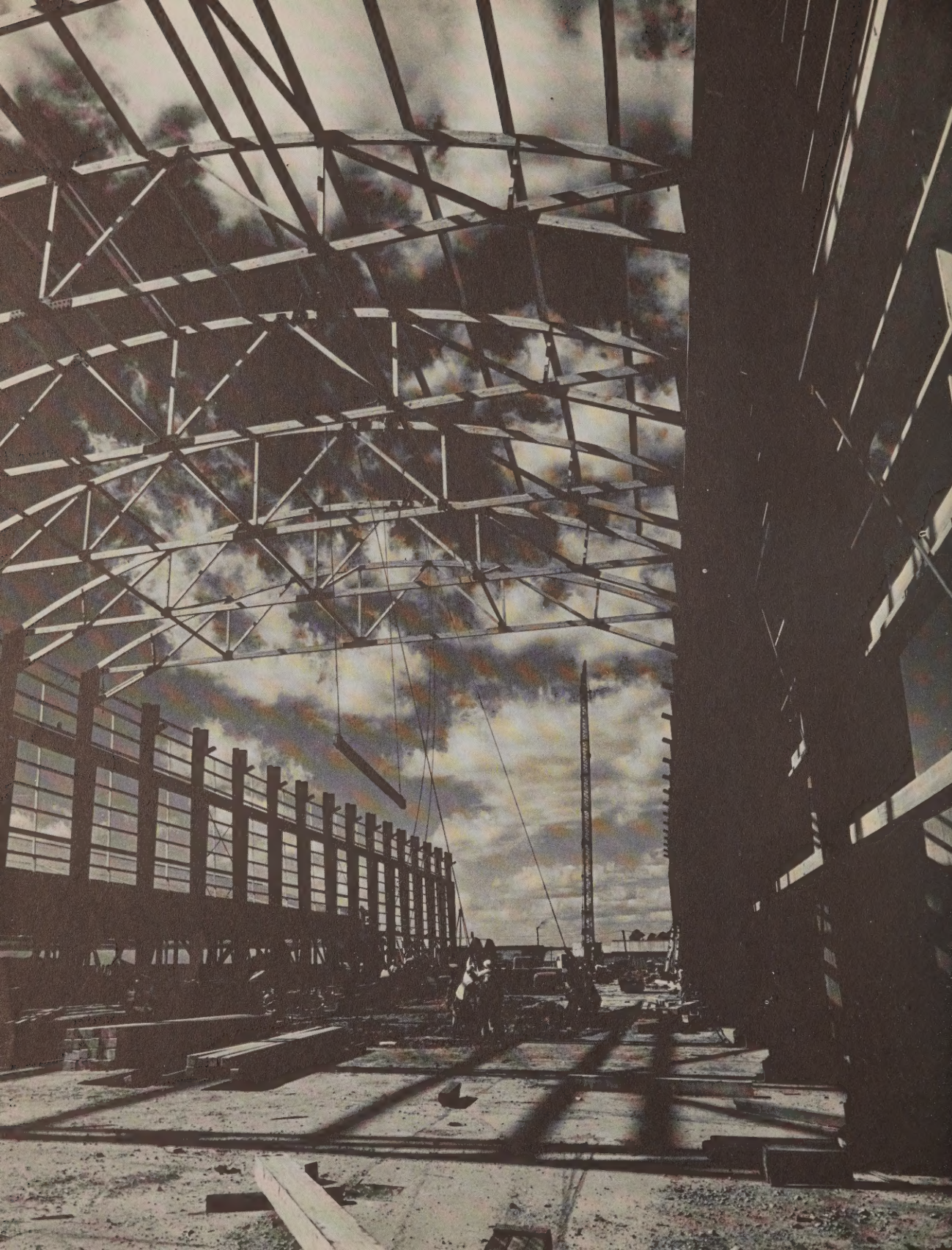

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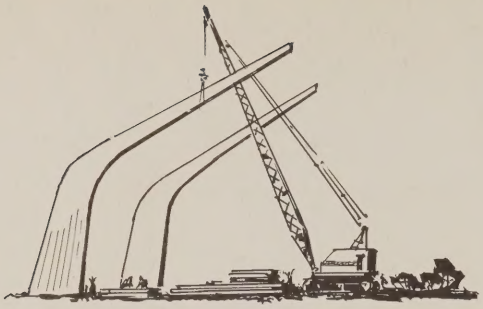


FOREWORD

Heavy Timber Construction is one of the oldest types of buildings used in the development of this country. Its superior performance has been demonstrated in thousands of buildings during the past hundred and fifty years. A large number of them are still in satisfactory use.

As originally conceived, the heavy timber building was a multi-story structure, designed and used primarily for industrial and storage purposes. Today, its use has been expanded to include many other occupancies. It is commonly used for assembly and mercantile buildings, such as schools and churches, auditoriums, gymnasiums, supermarkets, and for various other structures.

In keeping with the current trend to spread buildings out rather than upward, many of the modern heavy timber buildings are large in area and one story in height. However, where land is limited, the modern multi-story heavy timber building has proved to be entirely practical and satisfactory.

By using stress-graded lumber, either solid-sawn or glued-laminated, precise structural design procedures can be applied to heavy timber framing, resulting in a completely engineered structure. With properly designed fastenings such building can be relied upon to carry safely all anticipated loads.

Information on structural design will be found in the National Design Specification For Stress-Grade Lumber and Its Fastenings recommended by the National Lumber Manufacturers Association.

The excellent fire resistance of heavy timber framing has been demonstrated in many building fires over the years. Building codes recognize its superior performance by allowing larger sizes for buildings of this type. It is recognized in fire insurance rating schedules through lower rates.

In assembly buildings the beauty of exposed wood combined with the fire resistance of the heavy timber framing has produced highly desirable results. Most of the outstanding examples of modern church architecture have used this method of construction. It is to be found in many fine auditoriums and schools. These are the show places where esthetics are important. But it also is widely used in mercantile, industrial and storage buildings where utility and economy are prime factors to be considered.

This publication defines the minimum requirements for heavy timber construction, and provides illustrations of good construction details. These are recommended to the architect and builder as a guide in developing a safe and economical form of construction.

The definition is in a form suitable for adoption in building codes.

Definition of Heavy Timber Construction

GENERAL

Heavy Timber Construction is that type in which fire resistance is attained by placing limitations of minimum sizes on wood structural members and on minimum thickness and composition of wood floors and roofs; by avoidance of concealed spaces under floors and roofs; by use of approved fastenings, construction details, and adhesives for structural members; and by providing the required degree of fire resistance in exterior and interior walls.

FRAMING MEMBERS

A. Columns

(1) Wood columns may be sawn or glued-laminated and shall be not less than 8 inches, nominal, in any dimension when supporting floor loads, and not less than 6 inches, nominal, in width and 8 inches, nominal, in depth when supporting roof and ceiling loads only.

(2) Columns shall be continuous or superimposed throughout all stories by means of reinforced concrete or metal caps with brackets, or shall be connected by properly designed steel or iron caps, with pintles and base plates, or by timber splice plates affixed to the columns by means of metal connectors housed within the contact faces, or by other approved methods.

B. Floor Framing

(1) Beams and girders of wood may be sawn or glued-laminated and shall be not less than 6 inches, nominal, in width and not less than 10 inches, nominal, in depth.

(2) Framed or glued-laminated arches which spring from the floor line and support floor loads shall be not less than 8 inches, nominal, in any dimension.

(3) Framed timber trusses supporting floor loads shall have members of not less than 8 inches, nominal, in any dimension.

C. Roof Framing

(1) Framed or glued-laminated arches for roof construction which spring from the floor line and do not support floor loads shall have members not less than 6 inches, nominal, in width and 8 inches, nominal, in depth for the lower half of the height and not less than 6 inches, nominal, in any dimension for the upper half of the height.

(2) Framed or glued-laminated arches for roof construction which spring from the top of walls or wall abutments, framed timber trusses and other roof framing which do not support floor loads,

shall have members not less than 4 inches, nominal, in width and not less than 6 inches, nominal, in depth. Spaced members may be composed of two or more pieces not less than 3 inches, nominal, in thickness when blocked solidly throughout their intervening spaces or when such spaces are tightly closed by a continuous wood cover plate of not less than 2 inches, nominal, in thickness, secured to the underside of the members. Splice plates shall be no less than 3 inches, nominal, in thickness. When protected by approved automatic sprinklers under the roof deck, such framing members shall be not less than 3 inches, nominal, in width.

D. Construction Details

(1) Wall plate boxes of self-releasing type, or approved hangers, shall be provided where beams and girders enter masonry. An air space of 1/2-inch shall be provided at the top, end and sides of the member unless approved durable or treated wood is used.

(2) Girders and beams shall be closely fitted around columns and adjoining ends shall be cross-tied to each other, or intertied by caps or ties, to transfer horizontal loads across the joint. Wood bolsters may be placed on tops of columns which support roof loads only.

(3) Where intermediate beams are used to support floors, they shall rest on top of the girders, or shall be supported by ledgers or blocks securely fastened to the sides of the girders, or they may be supported by approved metal hangers into which the ends of the beams shall be fitted closely.

(4) Columns, beams, girders, arches and trusses of material other than wood shall have a fire resistance rating of not less than one hour.

(5) Wood beams and girders supported by walls required to have a fire resistance rating of two hours or more shall have not less than 4 inches of solid masonry between their ends and the outside face of the wall, and between adjacent beams.

(6) Adequate roof anchorage shall be provided.

FLOOR DECKS

Floors shall be without concealed spaces. They shall be of sawn or glued-laminated plank, splined, or tongued and grooved, of not less than 3 inches, nominal, in thickness, or of planks not less than 4 inches, nominal, in width set on edge and well spiked together. The planks shall be laid so that no continuous line of joints will occur except at points of support and they shall not be spiked to supporting girders. Planks shall be covered with 1-inch, nominal, tongued and grooved flooring laid crosswise or diagonally. Planks and flooring shall not extend closer than 1/2 inch to walls to provide an expansion joint, and the joint shall be covered at top or bottom.

ROOF DECKS

Roofs shall be without concealed spaces and roof decks shall be sawn or glued-laminated, splined or tongued-and-grooved plank, not less than 2 inches, nominal, in thickness, or of planks not less than 3 inches, nominal, in width set on edge and spiked together as required for floors. Other types of decking may be used when approved by the building official.

WALLS

A. Bearing Walls

Bearing portions of exterior and interior walls shall be of approved non-combustible material and shall have a fire resistance rating of not less than 2 hours, except that where a horizontal separation of 3 feet, or less, is provided, bearing portions of exterior walls shall have a fire resistance rating of not less than 3 hours.

B. Non-Bearing Walls

Non-bearing portions of exterior walls shall be of approved non-combustible materials except as otherwise noted and:

(1) Where a horizontal separation of 3 feet, or less, is provided, non-bearing exterior walls shall have a fire resistance rating of not less than 3 hours.

(2) Where a horizontal separation of more than 3 feet but less than 20 feet is provided, non-bearing exterior walls shall have a fire resistance rating of not less than 2 hours.

(3) Where a horizontal separation of 20 feet to 30 feet is provided, non-bearing exterior walls shall have a fire resistance rating of not less than one hour.

(4) Where a horizontal separation of 30 feet, or more, is provided, non-bearing exterior walls may be construction conforming to the heavy timber sizes specified herein for roofs, or of approved non-combustible materials not required to have a fire resistance rating.

(5) Where a horizontal separation of 20 feet, or more, is provided wood columns and arches conforming to heavy timber sizes may be used externally.

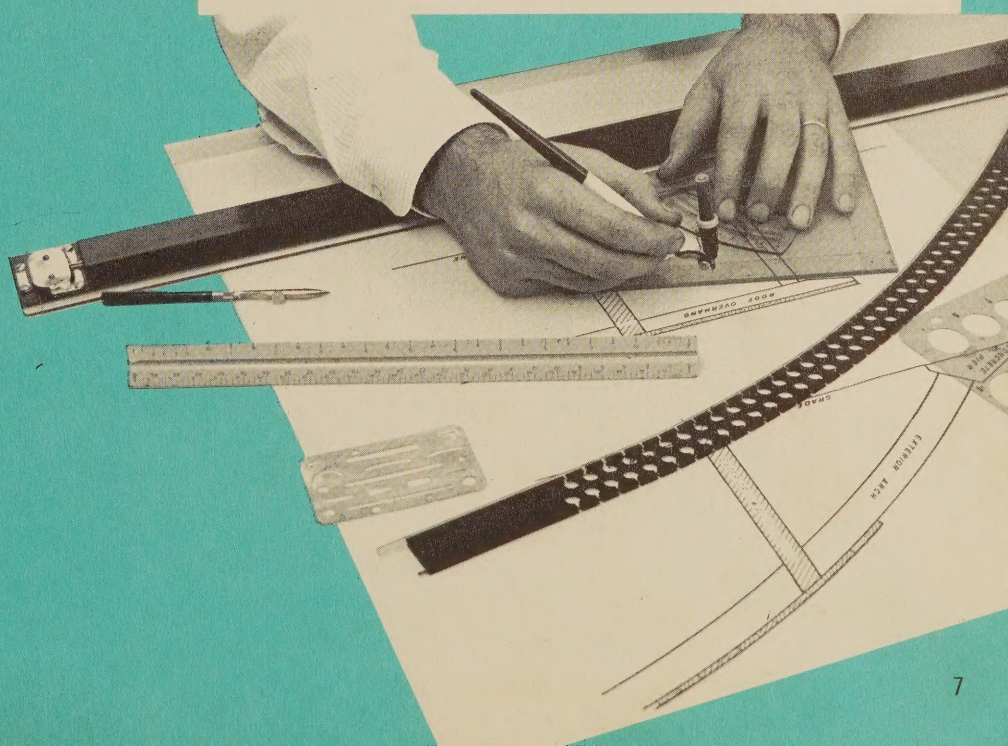
ILLUSTRATIONS

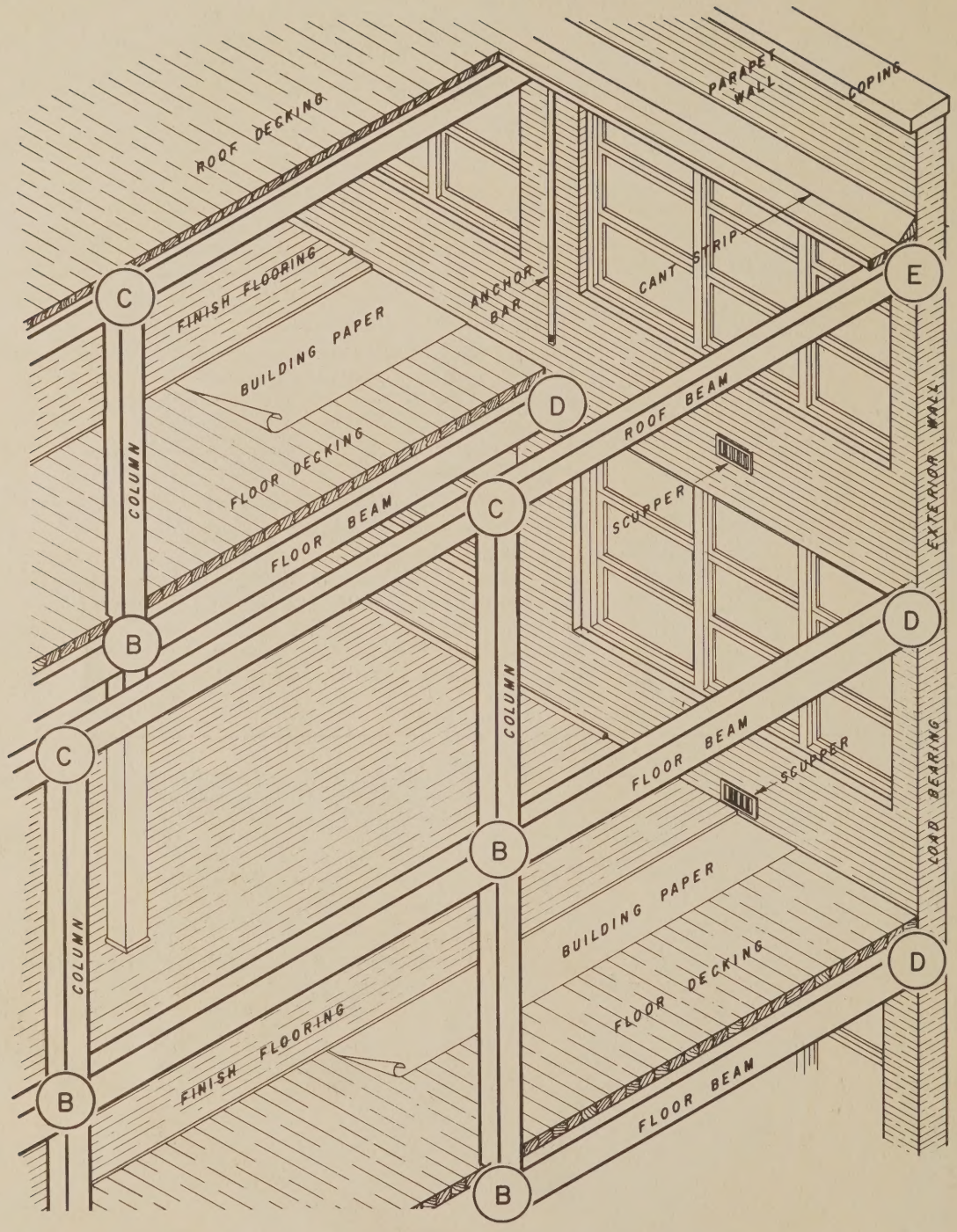
The illustration on the following pages include recommended construction details which have been found through experience to be satisfactory. The number and size of bolts, lag screws or connectors should be determined through analysis of the loads to be supported.

Pages 8 and 10 show sections through multi-story buildings with the connections between members indicated by an encircled letter, such as (B). Details pertinent to each encircled letter are included on pages 12 through 18. Various alternate methods are shown for each connection with the choice left to the designer on the basis of job conditions.

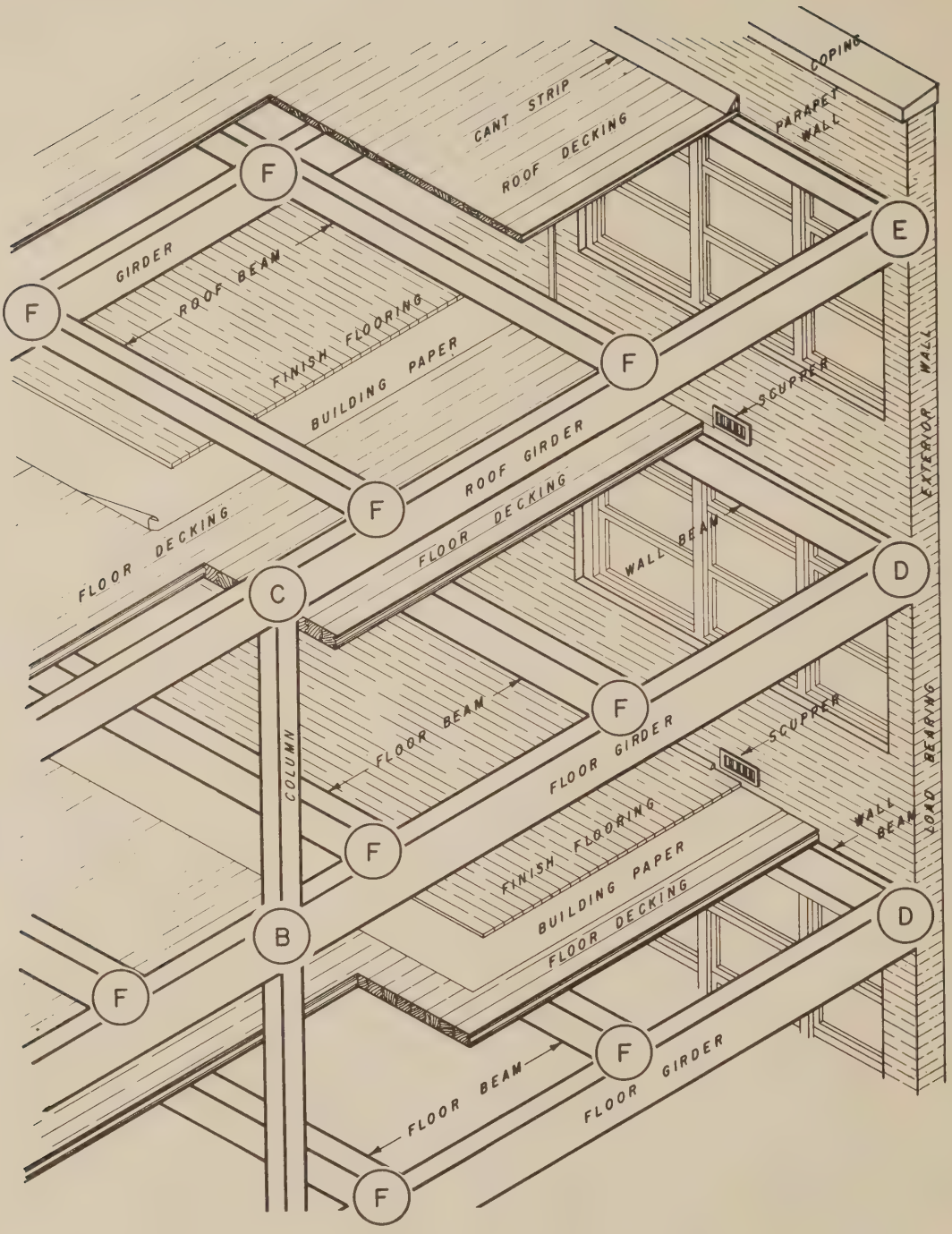
Pages 19 and 20 include miscellaneous construction details.

Pages 22 through 27 include illustrations and details for one-story buildings. These represent only a few of the many methods used in one-story heavy timber buildings. Because of the varied forms and arrangement of members in such buildings the timber fabricating firms find it practical to design each joint and its fastenings to meet the specific job conditions. Thus no attempt was made to cover completely details for these buildings in this publication.

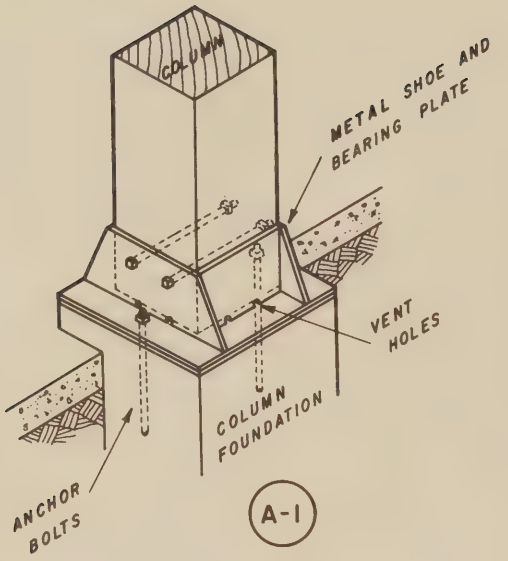


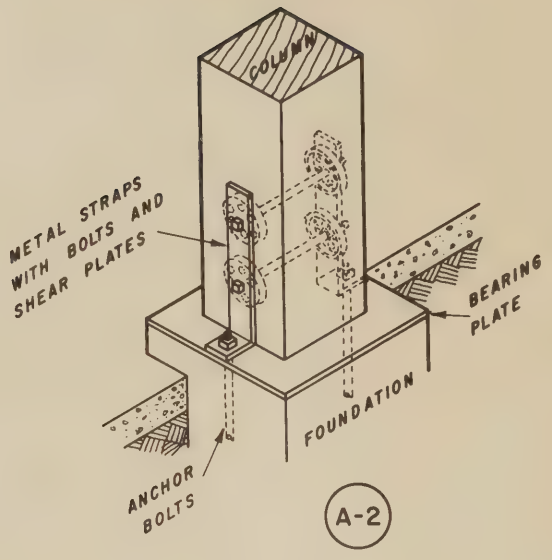


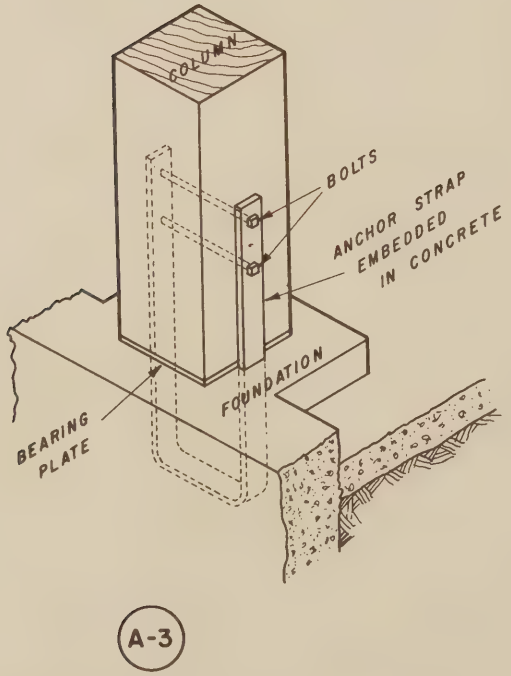
MULTI-STORY BUILDING
DECKING ON BEAMS

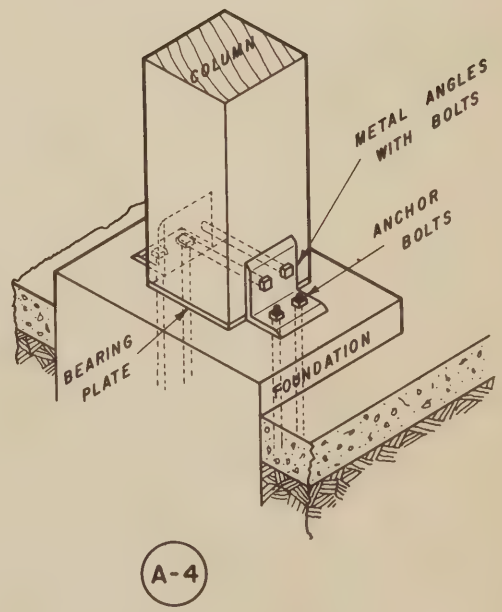


MULTI-STORY BUILDING
DECKING ON BEAMS AND GIRDERS

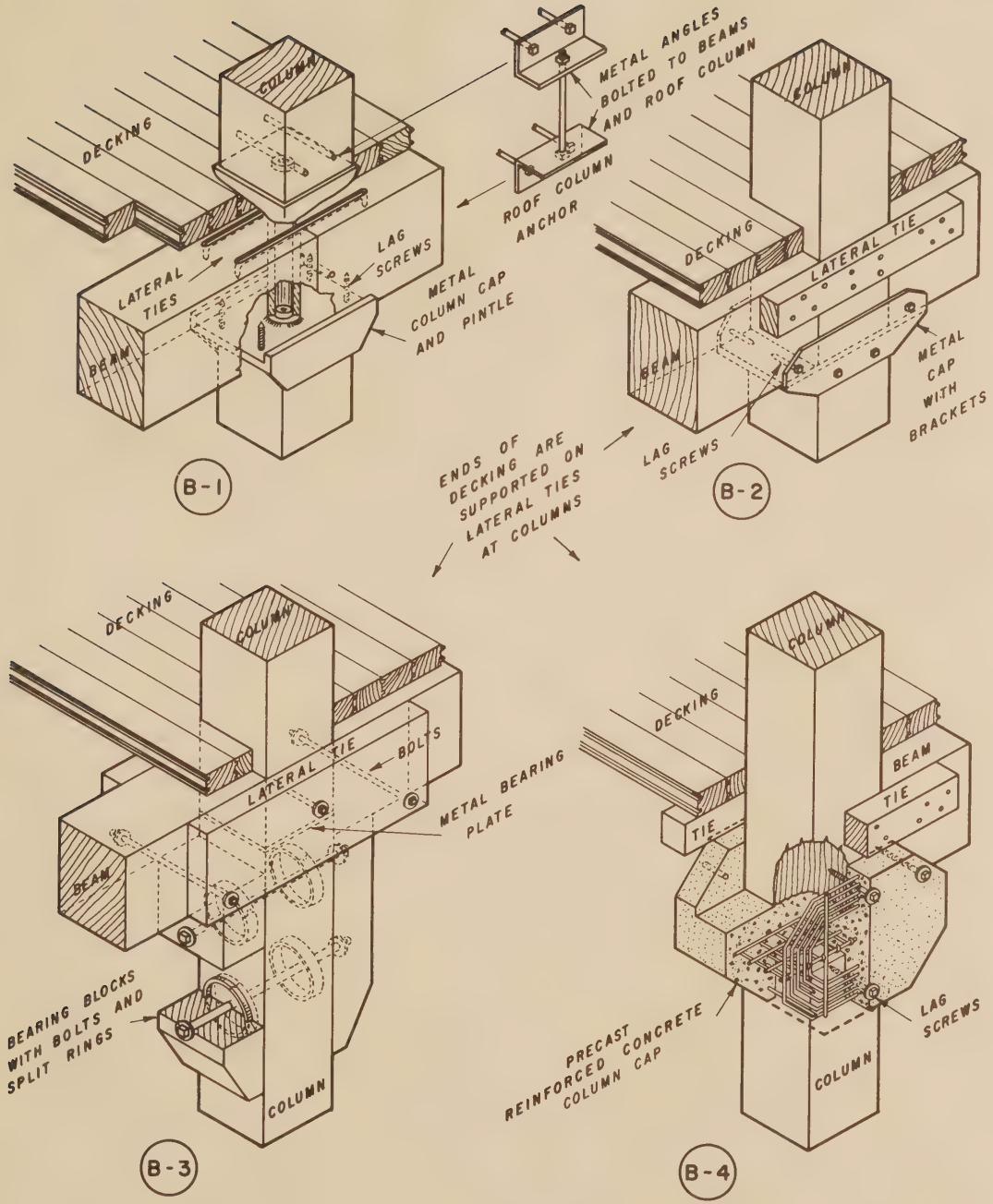




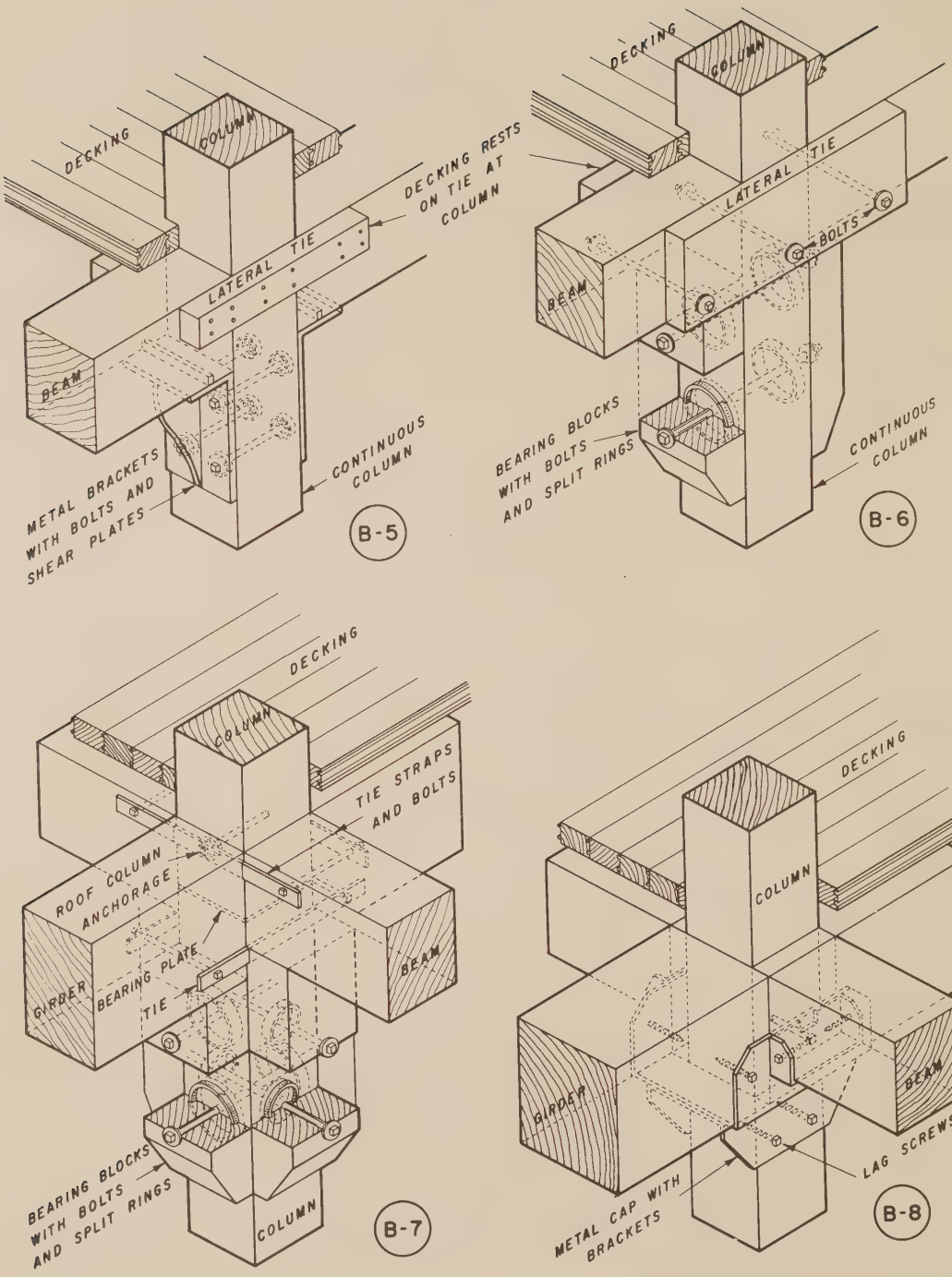




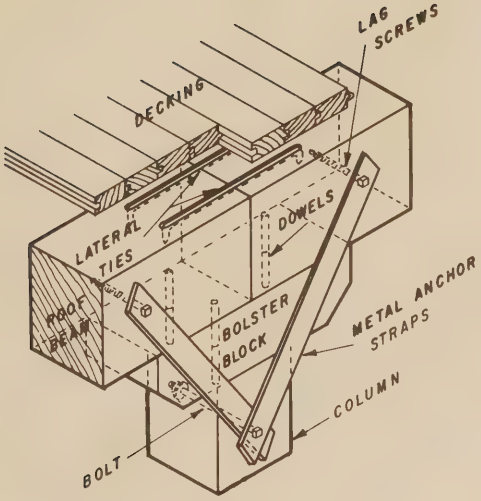
DETAIL A - COLUMN ANCHORAGE



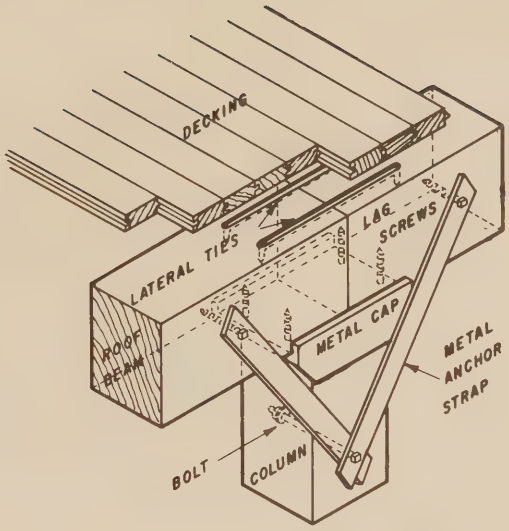
DETAIL B - FLOOR BEAM AND COLUMN FRAMING



DETAIL B - FLOOR BEAM AND COLUMN FRAMING



C-1



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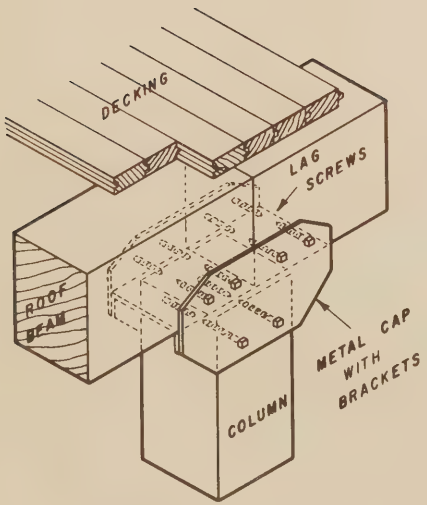

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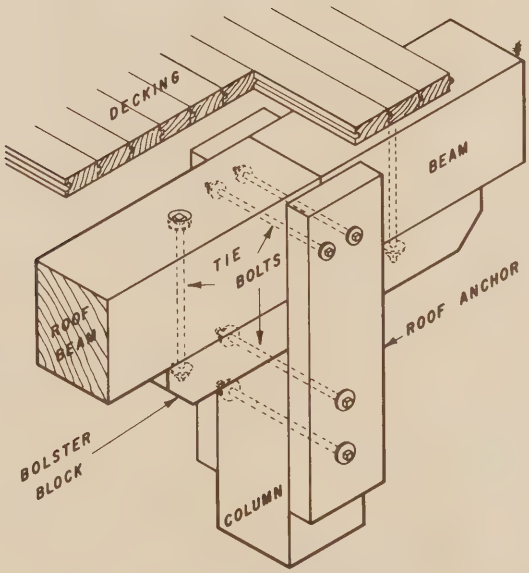
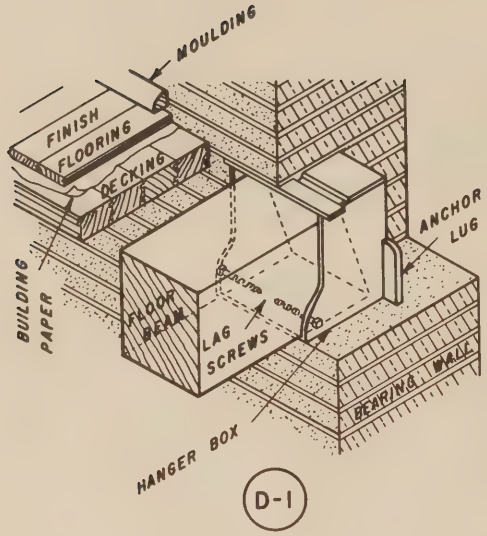


C-4

DETAIL C - ROOF BEAM AND COLUMN FRAMING



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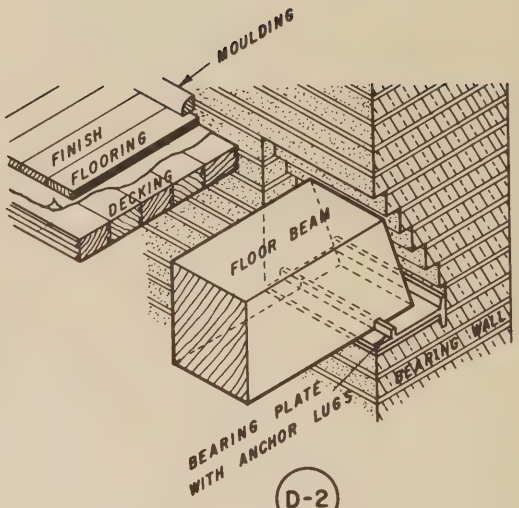

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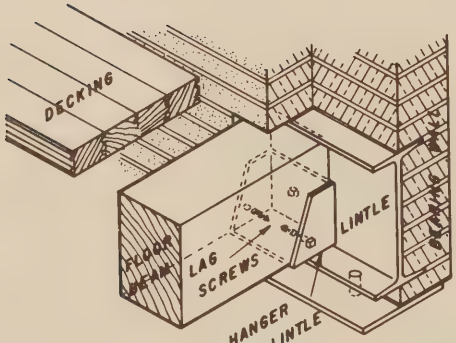

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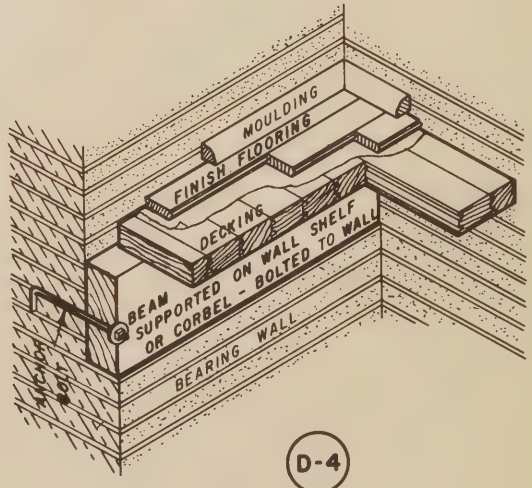
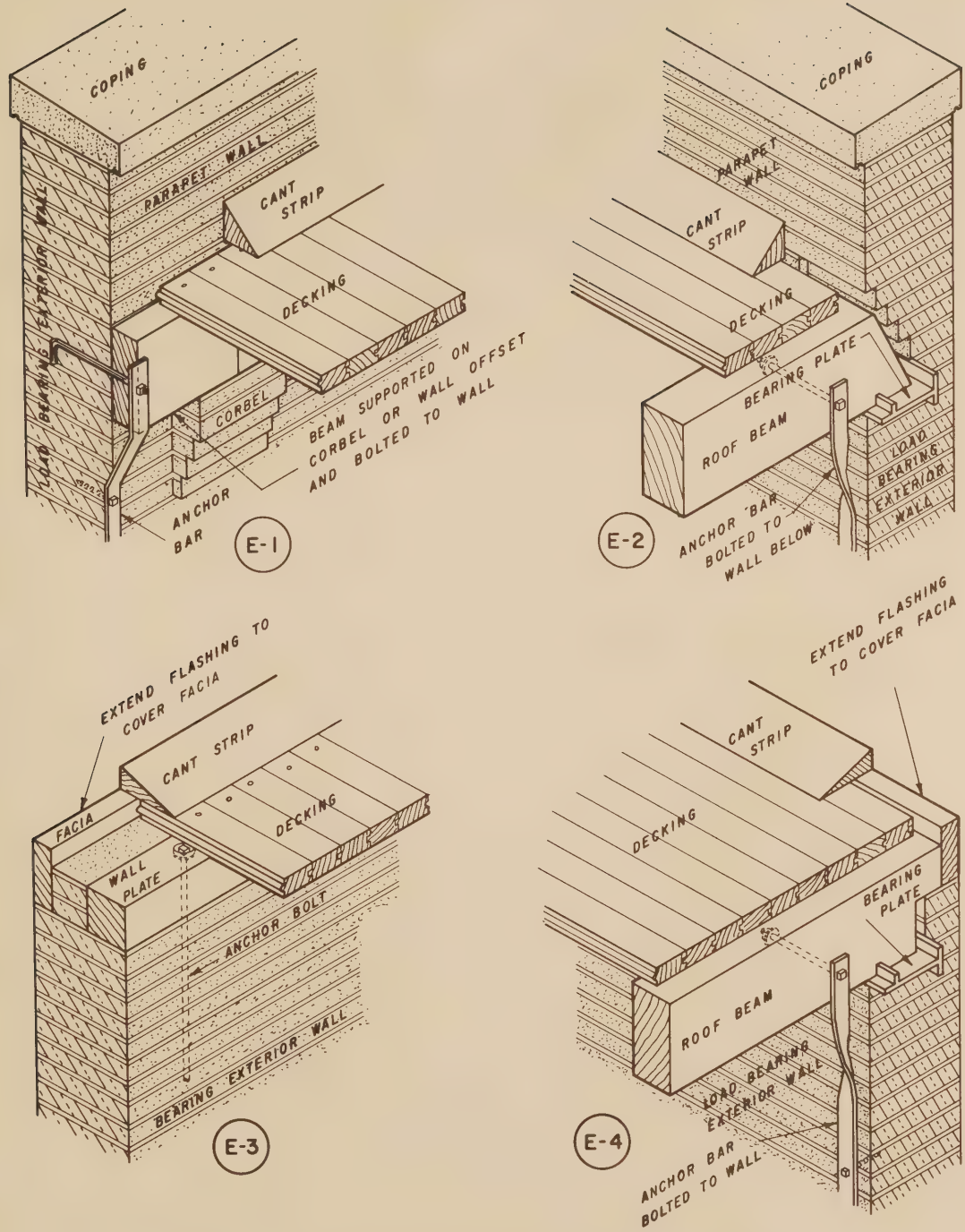
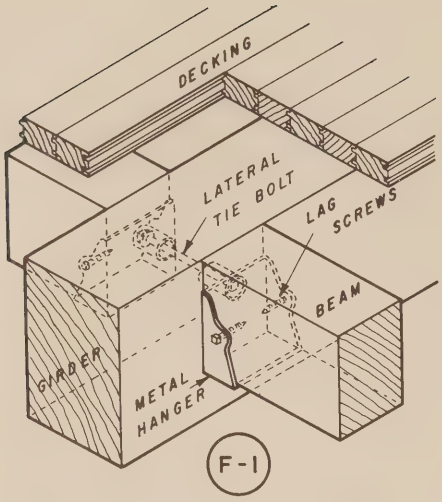


D-4

DETAIL D - FLOOR FRAMING AT EXTERIOR WALL



DETAIL E - ROOF FRAMING AT EXTERIOR WALLS



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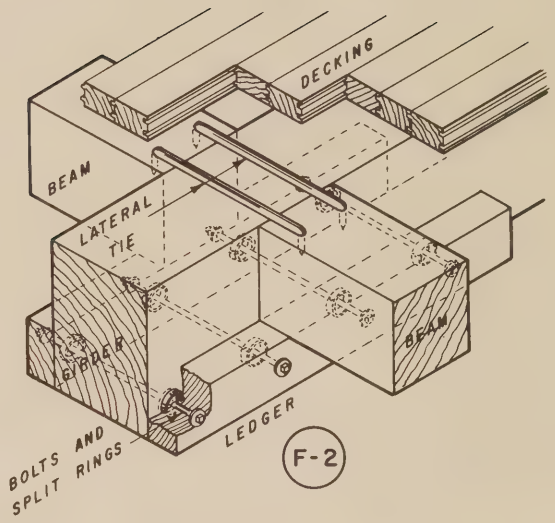

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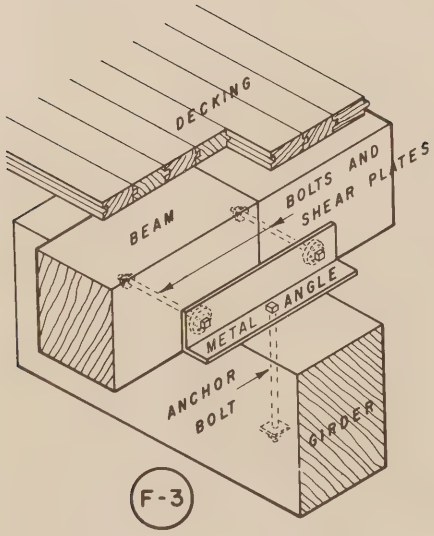

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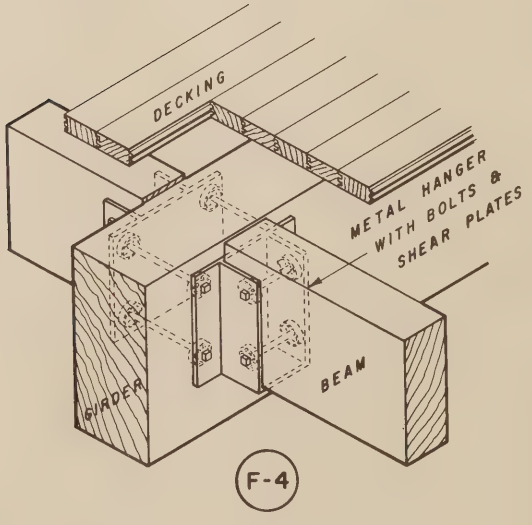
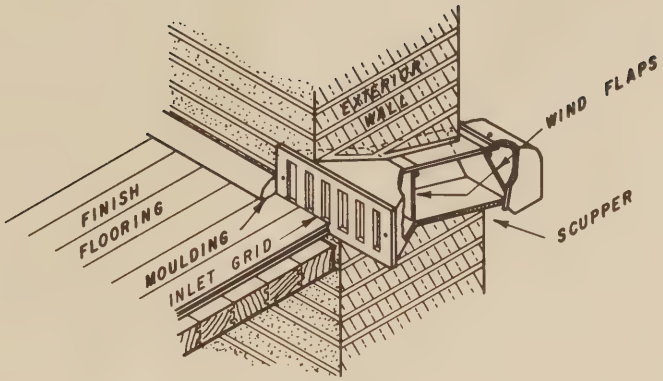
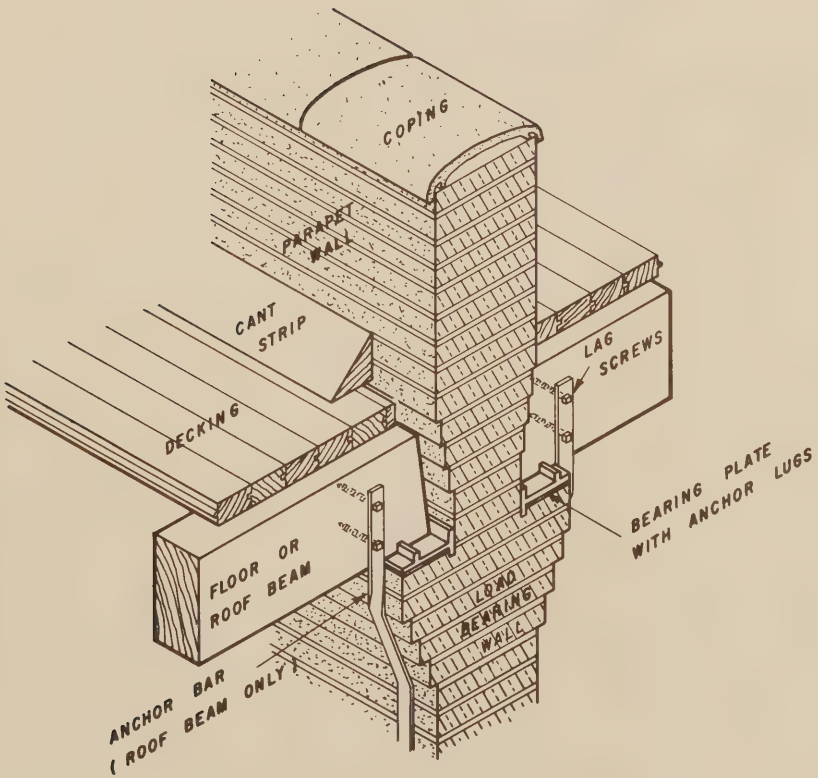


F-4

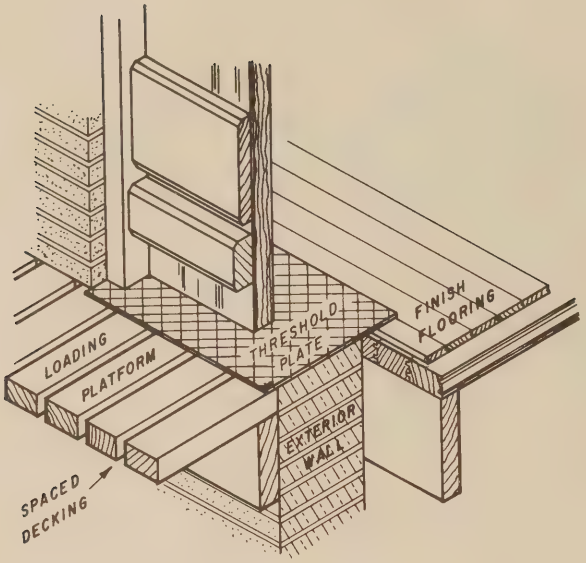
DETAIL F - BEAM AND GIRDER FRAMING



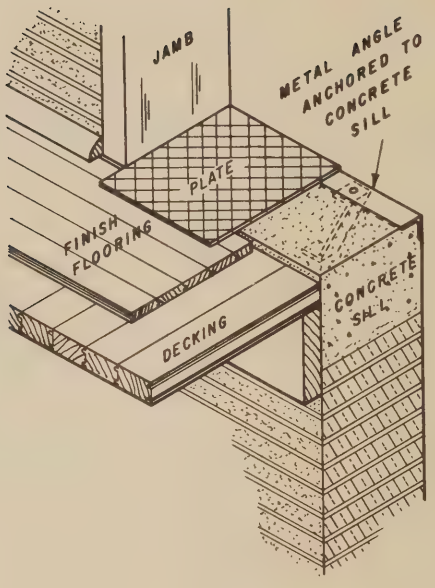
DETAIL AT SCUPPER



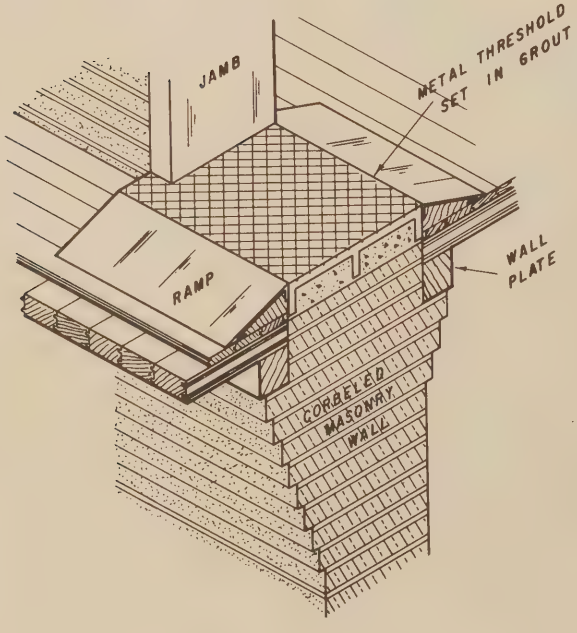
TYPICAL FRAMING AT FIRE OR PARTY WALL

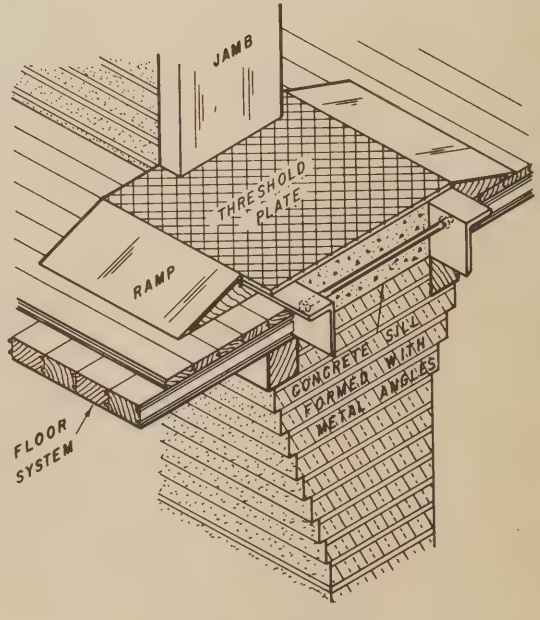


LOADING PLATFORM DOOR SILL

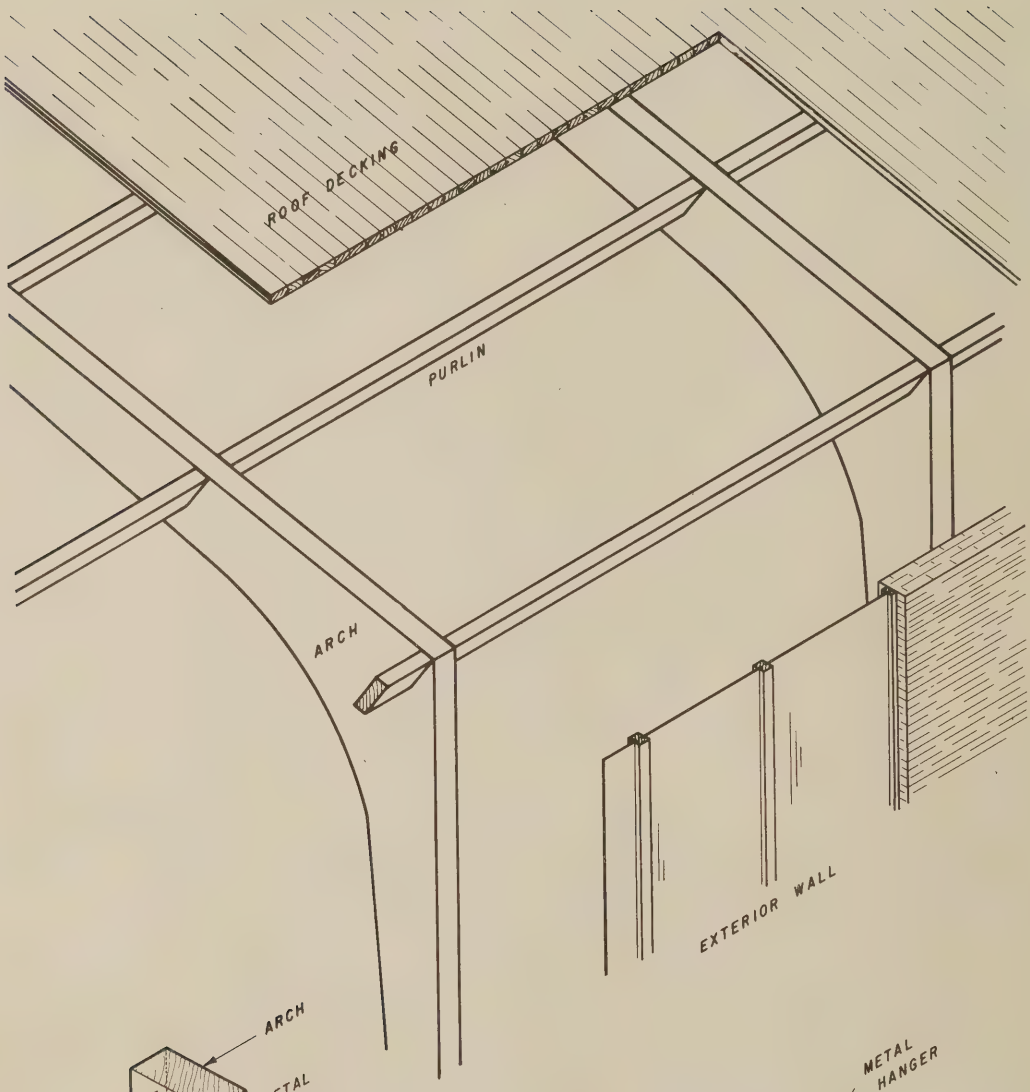


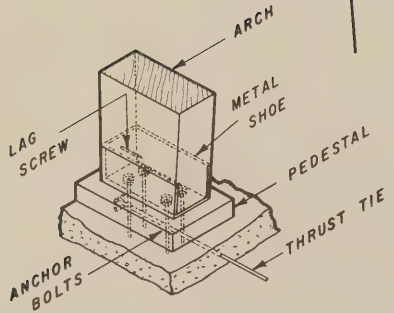
ELEVATOR DOOR SILL



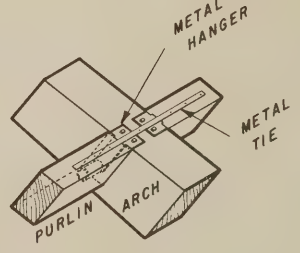


TYPICAL FIRE DOOR SILL DETAILS



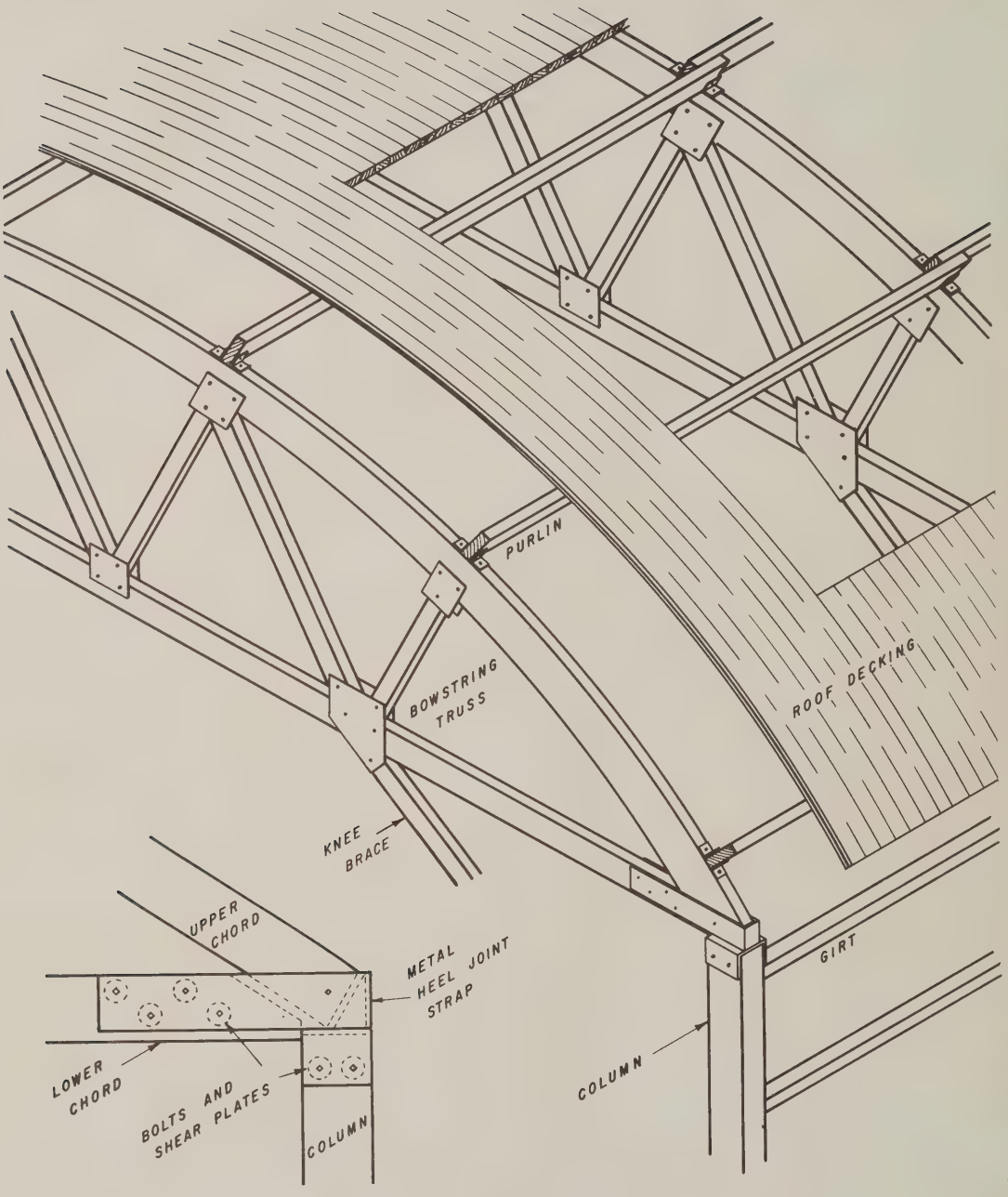


FLOOR CONNECTION



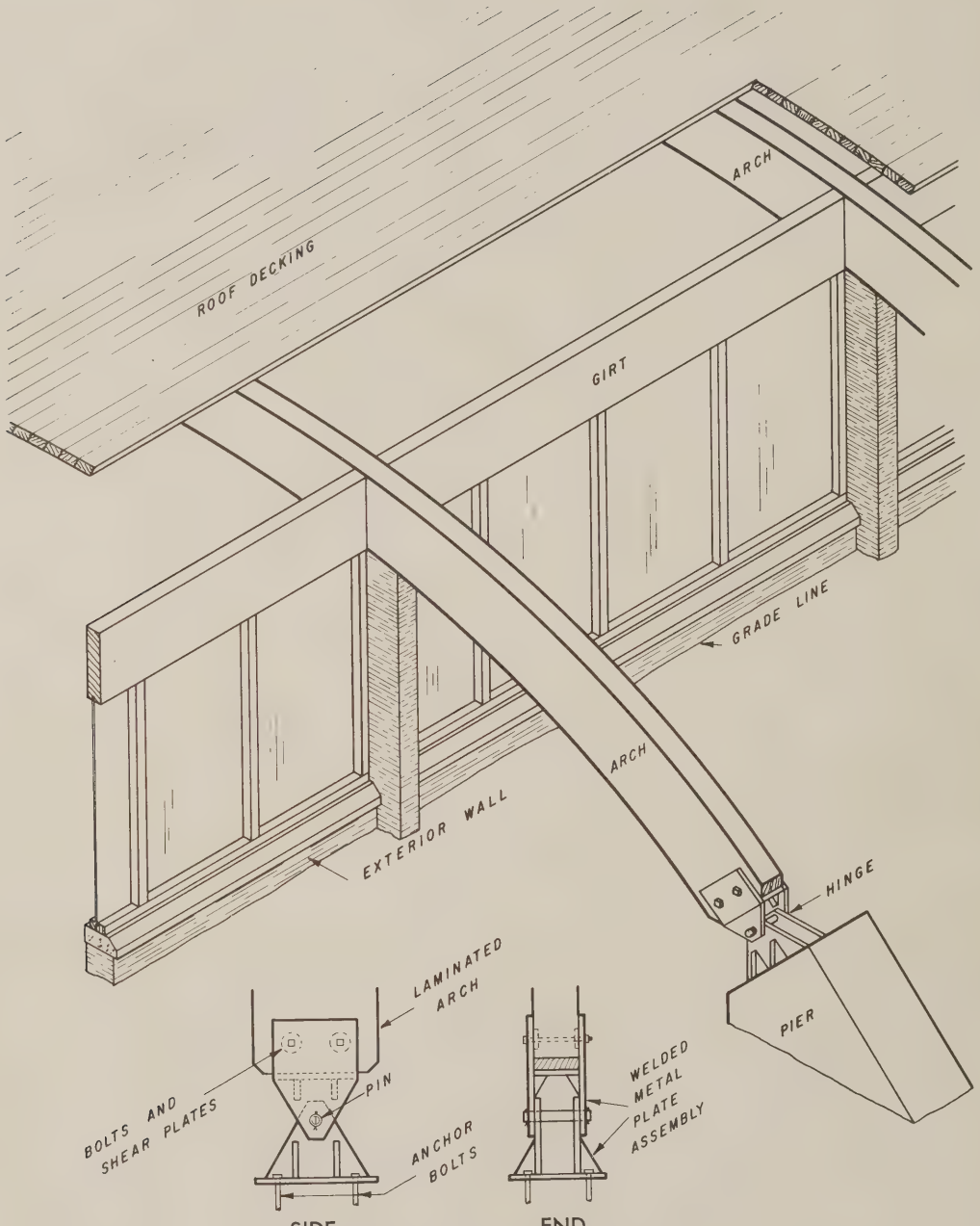
CONCEALED PURLIN HANGER

RIGID ARCH SUPPORTED AT FLOOR



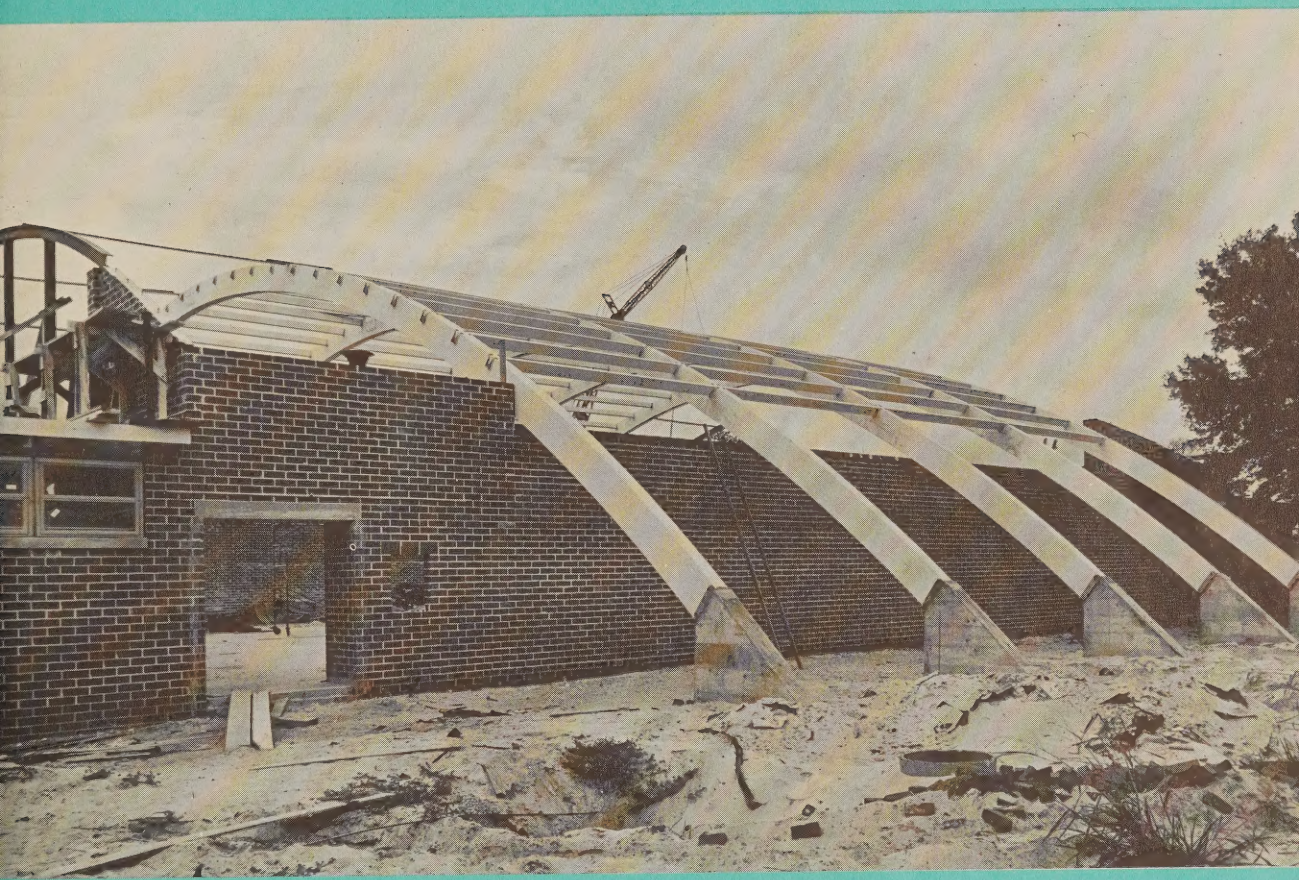
COLUMN AND TRUSS CONNECTION

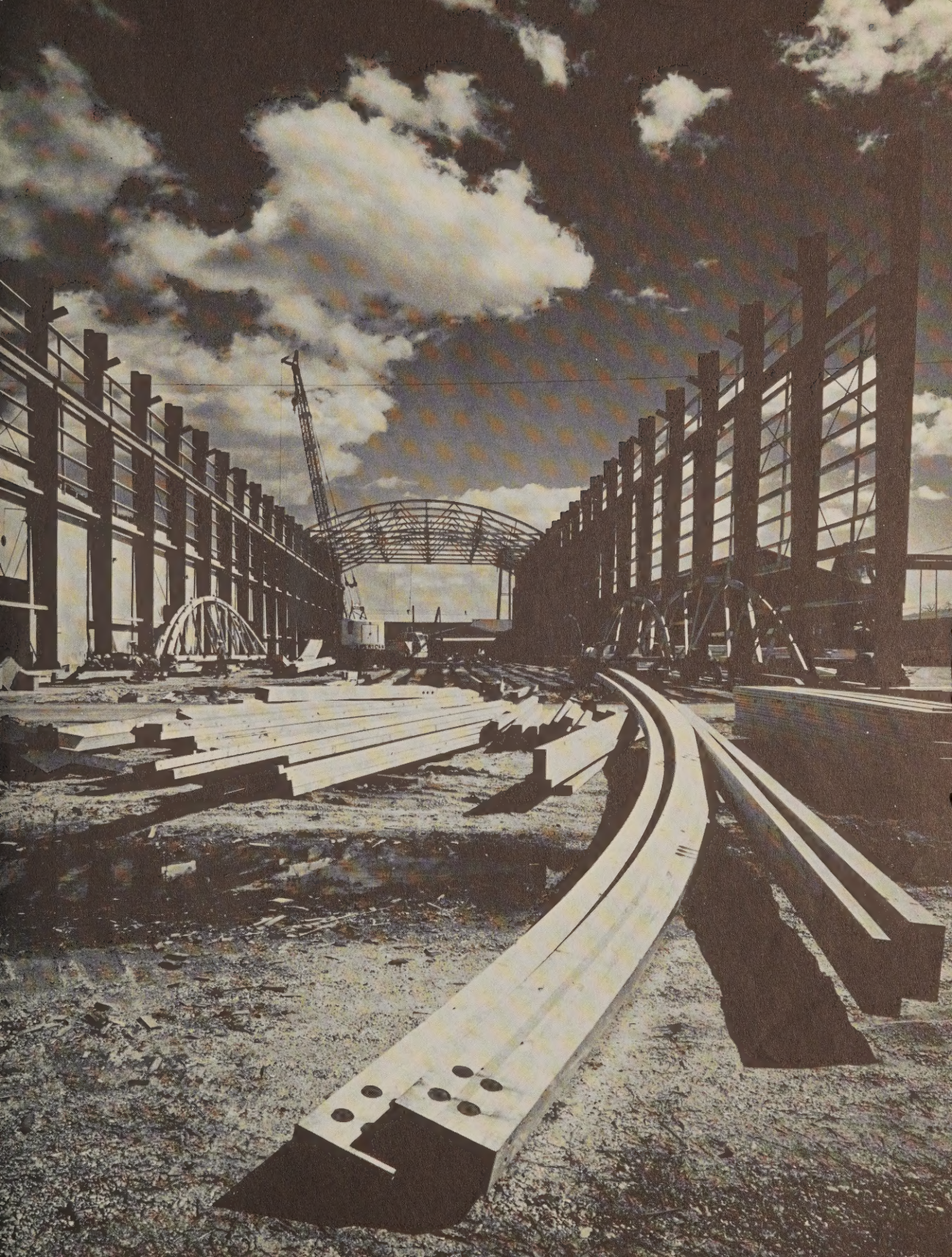
BOWSTRING TRUSS ON WOOD COLUMN



TYPICAL HINGE CONNECTION

BARREL ARCH ON EXTERIOR PIER





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TECHNICAL SERVICES DIVISION

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